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# Antimicrobial Use in Livestock in Low-Income Countries

## Introduction

**Since their discovery in the late 1920s, antimicrobials[1] have been vital tools for both human and animal healthcare. However, the surge in resistance against antimicrobials in recent decades has had serious consequences for our ability to treat infections.**

**The emergence of resistant bacteria is directly associated with inappropriate use of antimicrobials (see Box 1). In many low- and middle-income countries, regulations regarding antimicrobial use are poor or non-existent. This, together with the expected growth of the livestock sector – a major consumer of antimicrobials – in low-income countries, may result in an increase in the amount of antimicrobials administered and have severe implications for healthcare (Robinson et al., 2016).**

## Why are antimicrobials used in livestock?

Antimicrobials are extensively used in many farming systems globally for several purposes. Just as in human medicine, antimicrobials might be used to treat bacterial infections in livestock, such as gastrointestinal and respiratory disease in growing animals.

In many low-income countries the bacterial disease burden is high, and antimicrobials may be essential to limit morbidity and mortality in livestock that threatens food security and livelihoods.

Furthermore, when administered sub-therapeutically in low doses, antimicrobials may have a prophylactic effect and can also promote growth (Hughes & Heritage, 2004).

## Global use of antimicrobials in livestock

Quantifying the amount of antimicrobials used in the livestock sector globally is not an easy task. There are no reports of actual antimicrobial sales in low- and middle-income countries. In fact, estimates of antimicrobial consumption in livestock rearing can only be obtained from a few high-income countries. The same holds true for antimicrobials used for human consumption.

A report published in 2015 estimated global antimicrobial use in food animals to be around 63 000 tons per year (Van Boeckel et al., 2015). The authors estimated that China, the United States and Brazil account for the largest consumption of antimicrobials in livestock production (Figure 1).

Largely as a result of this, by 2030 antimicrobial use in livestock is projected to increase globally by almost 70%. Apart from the top consumers, the largest relative increase is projected to take place in the developing world; Myanmar, Indonesia and Nigeria are among several countries that may experience an increase of more than 200%.

## KEY MESSAGES

1. Antimicrobials are used in livestock production to maintain health and productivity of the animals, contributing to food security, nutrition and livelihoods for farmers.
2. Population growth, urbanization and rising incomes in low-income countries drive up the demand for animal-source foods. To meet this growing demand, farmers are intensifying their production, which often leads to increased use of antimicrobials.
3. Inappropriate use of antimicrobials in the livestock sector contributes to development of antimicrobial resistance.
4. Antimicrobial resistance is an emerging One World - One Health issue, because resistance does not respect national borders and can be transmitted between animals, humans and the environment.

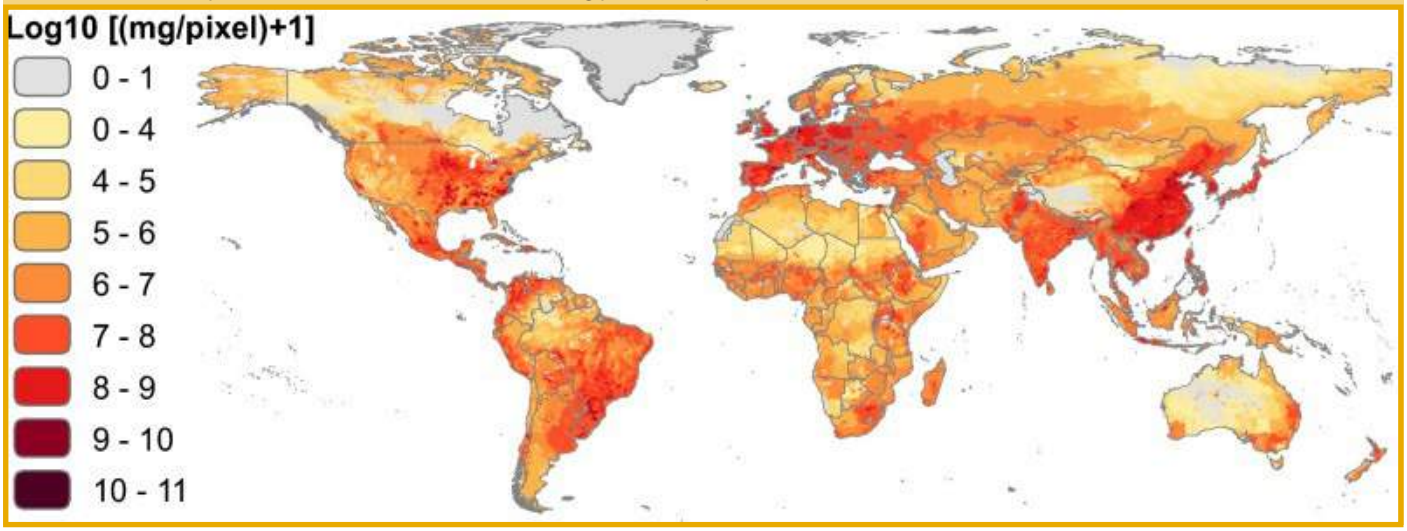
*A view inside a commercial chicken farm holding 5000 layer hens. With good hygiene and better farming practices the use of antimicrobials may be reduced. Photo credit: FAOALC via Flickr (CC BY-NC-SA 2.0).*

## RECOMMENDATIONS

1. Global data collection about the use of antimicrobials in humans and animals, and about trends in antimicrobial resistance needs to improve. More knowledge is also needed about the importance of different transmission routes among humans, livestock and the environment.
2. Regulations about use of antimicrobials are important, but must be tailored so they are acceptable for producers in low-income countries, and should be accompanied by awareness-raising about the risks of improper antimicrobial use for health, food security, nutrition and livelihoods.
3. Restrictions on antimicrobial use must be complemented with support for improved animal health systems to maintain livestock productivity. The experience of countries like Sweden can be a good resource in this regard.

[1] Although we use the general term "antimicrobial" – which includes agents such as anti-fungals – the focus of this brief is on antibiotics, targeted against bacteria.

Figure 1.
Antimicrobial consumption in food animals around the world (mg per 10 km2 pixel).




*Source: Van Boeckel et al., 2015. Global trends in antimicrobial use in food animals. Proceedings of the National Academy of Sciences of the United States of America, 112(18), pp. 5649-54.*

## Antimicrobials and the livestock revolution

The underlying driver for the increased antimicrobial use in livestock is the so-called livestock revolution taking place in many low- and middle-income countries (Delgado et al., 1999).

Population growth, accelerated urbanization, and rising incomes for many people in low- and middle-income countries are driving new demand for animal-source foods. In order to meet this increased demand, livestock production systems in several of these countries are becoming more intensive in a bid to be more productive. This in turn reduces production costs and ultimately retail prices for animal products.

The current intensification trend is mainly seen in East and Southeast Asia, and is most frequent in poultry and pork production.

Intensive livestock production usually implies that animals are kept at higher densities. This increases the risk of infection, making preventive antimicrobial use a common way to mitigate this risk.

*Three- month old pigs at a Cambodian pig farm. Antimicrobials are often used at weaning to reduce the incidence of post-weaning diarrhoea.*
*Photo credit: Gunilla Ström, SLU.*

## Risks of antimicrobial use in livestock production

Although antimicrobials may be essential in order to maintain health and productivity of livestock, more and more scientists agree that antimicrobial use in livestock production risks increasing antimicrobial resistance in human pathogens (see e.g. Wang et al., 2012). Many of the antimicrobials used in livestock production have been classified by the World Health Organization (WHO, 2012) as critically important for human medicine. Thus using the same substances for animals could favour selection of resistant bacteria that may cause disease in humans.

Resistant bacteria in livestock can be transmitted to humans through direct contact with the animals or through consumption of animal products (see Figure 2). As many antimicrobials are only partially absorbed by the body, antimicrobial residues, as well as resistant bacteria and resistance genes, may be excreted in the manure (Heuer et al., 2011; Campagnolo et al., 2002). Hence there is also a risk that these substances and organisms end up in the environment.

### Box 1. Antimicrobial resistance

The emergence of bacteria that are resistant to current antimicrobials is a global health concern, threatening our ability to treat common infectious diseases. Non-rational use of antimicrobials in humans and animals has been linked to the emergence of resistant bacteria. Some bacteria are naturally resistant to certain types of antimicrobials, while others acquire resistance in different ways, such as genetic mutation or the uptake of resistance genes, either from other resistant bacteria (so-called horizontal gene transfer), or from the environment. Improper dosing with antimicrobials – too little, for too short a period, or the wrong antimicrobial – can accelerate the build-up of resistance (WHO, 2014).

An increasing problem is bacteria that have acquired resistance against several types of antimicrobials. These multidrug-resistant bacteria are often referred to as "superbugs" and may cause infections that are very difficult to treat. Another problem is the fact that resistance against one type of antimicrobial often confer resistance against other types with similar mechanisms of action.

Sub-therapeutic antimicrobial dosing to promote growth and overall performance is the most controversial use of antimicrobials. This type of low-dose use has a high potential for selection of resistant bacteria as these bacteria may be favoured over other susceptible ones (Hughes & Heritage, 2004). In Sweden, antimicrobial use for growth promotion has been banned since 1986, and the same ban was introduced in the entire European Union in 2006. In low-income countries, however, this use remains largely unregulated.

## Antimicrobial resistance issues in low-income countries

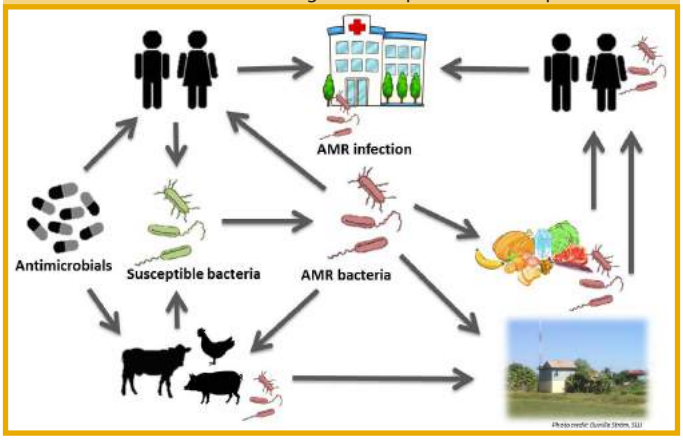
Although antimicrobial resistance (commonly abbreviated to AMR) is a global health concern, it is the people in low- and middle-income countries who suffer the most severe consequences. In India, for example, almost 60 000 infants die every year from infections caused by antimicrobial resistant bacteria (Laxminarayan et al., 2013). Poor healthcare systems and less than ideal sanitary conditions exacerbate the problem.

Several high-income countries have introduced control programs to monitor antimicrobial resistance, but in most low- and middle-income countries such surveillance systems are lacking. Many of these countries also lack a legislative framework that regulates the use of antimicrobials within the livestock sector.

There is also much concern about the use of counterfeit antimicrobials. These may contain less of the active ingredients than the authentic drug; substitute them for other, cheaper compounds; or even contain no active ingredients at all. Lack of active ingredients does not directly contribute to antimicrobial resistance but leads to ineffective treatment and economic losses for farmers, and may encourage them to use higher doses.

How resilient poor livestock farmers are to these consequences is not clear, but increased production costs will likely lead to higher food prices, with negative impacts on food security and poverty alleviation.

Figure 2.
Resistant bacteria in livestock can be transmitted to humans through direct contact with the animals or through consumption of animal products.




*Source: Modified from Thamlikitkul, 2015.*

## There are alternatives

The example of Sweden, where antimicrobials as growth promoters for livestock were phased out 30 years ago, resulting in the lowest use of antimicrobials per animal in the entire EU and a very low resistance occurrence, shows that it is possible to have good livestock productivity without excessive use of antimicrobials. Sweden has instead deployed alternative ways of preventing disease, such as increased vaccination rates, better biosecurity procedures and improved livestock management.

Where they are feasible, such alternatives can be particularly relevant for low-income countries where enforcement of regulations is difficult or effects of bans may be harmful for poor farmers. Obviously not all of the above mentioned alternatives can be directly applied in a low-income country setting, but some can.

*Cattle herd in Lukenya, Kenya. High stocking densities may facilitate disease transmission and therefore put higher demands on biosecurity and good farming practices in order to reduce the needs for antimicrobials. Photo credit: Jeff Turner via Flickr (CC BY-NC-SA 2.0).*

*Pigs at a free-range farm in Indonesia. With good biosecurity procedures and preventive measures good animal health may be maintained even if the antimicrobial use is reduced. Photo credit: carawah via Flickr (CC BY-NC-SA 2.0).*

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The views presented are solely the author's.